

THE  
OPERATOR  
For The  
TEETH.

SHewing  
How to Preserve the Teeth and Gums from all  
the Accidents they are subject to: With par-  
ticular Directions for Children's Teeth.  
As also the Description and Use of the POLICAN,  
Never Published before.

By CHARLES ALLEN; Professor of the same.

To which is Annexed

A Physical Discourse, wherein the reasons of the  
Beating of the Pulse, or Pulsation of the Arteries,  
together with those of the circulation of the Blood,  
are mechanically Explained; which was never  
done before.

By an Unknown Hand.

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Second edition  
Dublin 1682

OPERATOR

For The



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Christo P.D. Franc.  
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TO THE  
MOST HONOURABLE  
AND  
TRULY LEARNED

The Physicians, Chirurgeons and Apothecaries  
Of the City of DUBLIN  
GENTLEMEN,

**W**hen I see your INDEFATIGABLE  
Care in procuring men (that without  
which all the World is nothing) HEALTH, the  
PRIMARY cause, sole Foundation and Prop of  
Humane FELICITY; and how the experience  
of so many years manifests to all men, by the  
happy success of your Undertakings, and your  
great Charity to the Poor, that your private in-  
tentions do correspond admirably well with your  
external actions; and that all your indeavours  
are real and unfeigned: I am perswaded, that  
whatever can in any wise contribute to the pro-  
moting of your most Noble and Generous De-  
sign, can't but be acceptable to you. Where-  
fore having with the same passion, for the pub-

*The Epistle Dedicatory.*

lick Advantage, compos'd the following small Treatise, I take the liberty most humbly to present it You; that (as You are the best JUDGES of the thing) so You may by Your Judicious and Impartial Censure of it, inform the World of its worth; that no person may be deceiv'd in it. For my intentions in publishing it, being to advance the common Good; if I thought it did contain any thing contrary to that DESIGN, I shou'd be the first that wou'd endeavour its suppression.

But, GENTLEMEN, besides the foregoing reasons, which I had of offering You this first Essay of mine, I did it also to acquit my self in some measure of my Duty towards You; and to assure You further, that I am in all respects,

GENTLEMEN,

*Your Most Humble, Most Obedient,*

*And Most Obliged Servant*

CHARLES ALLEN.



# THE OPERATOR FOR THE TEETH.

## The PROEM.

**N**othing that it is the duty of every man, and especially of such as live under a Civil Government, (where the general Interest always includes the particular) to contribute as much as he can (in his own station) to the publick Good: and also of what Importance it is to all men to be informed of those Benefits which by my Art they may enjoy; I am resolved to set down here what I think most convenient for every one to understand concerning the preservation, and melioration of his own Teeth; A thing indeed of little esteem among most people, but in truth, of inestimable value for its many and important consequences. However, in so doing, I shall acquit my self of my duty towards God and Man. And provided my Endeavors prove but beneficial to others, (as certainly they will, if put in practice) it is all I desire, caring very little what opinion the Criticks of Words and artificial Logick may have of me.

Of what Utility this Undertaking of mine may be to every body, will appear by the sequel of this Discourse; whereof the  
scope

## The PROEM.

scope is to prevent the loss of **Teeth**; the use of which is so necessary in the preparing of food, that the want of such a help (if not supplied by strong dissolvents) hinders a true concoction of the **Aliments** in the **Stomach**; whence do proceed **Indigestions**, and abundance of **Crudities** very noxious to the body of man; as being the seed of most of those innumerable **Diseases** and **Infirmities**, whereby life is not only made troublesome to us, but also considerably shorter than it would otherwise be, which is so consonant to truth, that vulgar observation it self has turned it into a common Proverb: For they use to say of one whose **Teeth** are naturally thin, that he is short-liv'd, whereof the reason is, that such persons do not chew their meat well. Moreover, the loss of **Teeth** renders the pronounciation both troublesome to ones self, and unintelligible to others. In a word, the corruption, and want of them, is as great a deformity, and of as much prejudice to one, as any thing whatsoever can be.

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SECT.

SECTION I.

Of the Nature of the TEETH.

**W**Hat men are wont to call Science, or the Cognition of any being, is by them commonly divided into two several parts: one whereof is termed *Theoretical*, and the other *Practical*. The first includes the reasons and causes of things, with the order and manner of their progress in coming to be what they are. The second regards only their Properties and Effects, and what they are actually in themselves, without inquiring how they come to be so made, or thus qualify'd. As for example of those two branches of Humane Learning, (in respect to Physical matters) when Philosophers go about to inspect the nature of the *Loadstone*, they search into its *Origine*, tracing out the several causes of its Formation, even to their source or spring-head; from whence they draw arguments for the solution of all the *Phenomena* thereof; whereas Mariners consider it only as a certain Stone that draws Iron to it self, having the power of communicating its properties to the said Iron; and which, if not hindred (by its own gravity, or any other impediment) will always turn one of its sides towards the North, and another diametrically opposite to the first towards the South; which sufficeth them for the use they make on't, in directing their courses through the Sea, without caring what may be the cause of so admirable

mirable vertues in the *Magnet*. Either of which constituent parts of Knowledge being separated from the other, cannot afford a full and satisfactory account of a thing: And therefore being about to treat of my Art, I should by consequence begin with its *Theory*, and discourse of the *Elements*, *Principles*, and first *Rudiments* of the *Teeth*; which make the Subject thereof, unfolding the reasons of their constitution and frame, and how they come to have several Roots, and to grow above the Gums; with what ever else may be the cause of their specifical being; and thence pass to the *Practice*. But some Considerations obliging me to defer treating of the former Part, or *Theorick*, till a better opportunity, I design only to lay down in this Paper some of the most principal *Points* relating to the other; namely, the *Practical* part of my *Profession*. In doing which, although it would be enough for us to speak of things, as in the state wherein we find them: yet for the satisfaction of the Reader, and out of a real desire to serve him, we shall not destitute our Discourse of such Reasons as are necessary for the well understanding of what we shall say. So that although this *Treatise* will be imperfect, as wanting many things, yet what it shall contain, will be as useful and advantageous as if it were accompanied with all the rest. However, according to the method we have prescribed our selves here, we are to proceed next to the consideration of the *Structure*, and constitution or nature of the *Tooth*.

In *Analysing* the *Tooth*, its substance is not found to be



*The Operator for the Teeth.*

be uniform every where, but manifestly distinguishable into two different sorts of make: one of them being harder, whiter, and of a finer texture; and the other softer, more obscure, and of a courser composition. The first makes up the head of the Tooth, or that part of it that stands out naked above the Gums, and the other its stump, or that part on't which is hidden within the said Gums. The exposed part of the Tooth consists also of two different Parts: To wit, its stony Cover or Case, and its inward substance; the first is as it were an hard *Periosteum*, that invests the head of the Tooth on all sides, lying on it much after the same manner that Enamel does upon Gold, or any other thing. This natural Enamel which I call the gloss of the Tooth, is of a far harder, whiter, more dense and lucid nature than the inward substance lying under it: which for its several uses may properly be compared to the *Cuticula*, or Scarf-skin, for like unto this it is bloodless, and altogether destitute of sense, serving to cover and defend the extremities of the Vessels, contained within the inward substance, from external injuries, and to render the Tooth more beautiful and strong. It has pores for the perspiration of the excrements of the Tooth, which pores are not always of the same figure, nor magnitude, but vary almost in every body. The said gloss or stony substance is likewise very various in point of thickness: from which differences, do arise the diversity of its colour in several men.

The inward part of the head of the Tooth, though



inferior to its cover or gloss in brightness and solidity, yet its substance is nevertheless much more compact, and clearer than that of the stump: and contains two several sorts of pores, or small channels, both of a conical figure, having their *Bases* in the *concave superficies* of the Tooth, and their *Apexes* in the *convex superficies* of the inward substance, immediately under its glassy integument. Through some of which channels the blood is carried by many and very small *Arterial Sprigs*, from the middle of the Tooth to its extremity: and through the others the same blood is sent back again from the said extremity towards its middle, by some *capillary veins*, as shall be said hereafter.

As to the root or stump of the Tooth, it is the darkest, most soft, and porous portion of its whole substance; and yet is closer and harder than any other bone of the body, having also two sorts of channels, but of different situation from one another; for some of them have their *Bases* (like those above described) towards the cavity of the Tooth, and contain the branches of the Artery, that carry the blood quite through the substance of the Tooth, to the Gums, as shall be explained in its place, but the others contrary to any of those already mentioned, have their *Bases* towards the external superficies of the Tooth; the use of which last conduits, is to transmit to the Gums the blood that is returned to the heart from the *membrane* that invests the cavity of the Tooth. This rooty part of the Tooth consists in the small Teeth

of a single body, and in the big ones is divided into two, three, or four branches, called roots or fangs; along the middle of each of these fangs, there is a little channel that goes up to the head of the Tooth, where they are united together, and make but a single cavity, whereinto are carried the vessels of the Tooth, passing first through the hollowness of the stumps. Every Tooth has its particular cell or socket within the *Mandible*, distinct from all the rest (by a thin production of the jaw-bone passing between the Teeth, from one side of the said bone to the other) wherein most of its stump is comprehended, the rest being encompassed about with the Gums.

SECT. II.

*Of the Alteration of the Teeth, with their Remedies.*

**F**ROM the consideration of the nature of the Teeth, let us now pass to that of the first step of their degenerating, or mutation. For the better understanding of which, we shall take notice, that as our body is so made by nature, that it wasts continually by the dissipation of some Particles, separating themselves from its Mass, without intermission; (transpiring for the most part through the pores of the skin) and that if these particles (which being divided from the whole, become *Excrementitious*) are kept too long within the body, (by reason of the *Opilation* of the said pores) it causes Fevers, and great disorders in our blood, and vital as well as animal Functions: So likewise from

the substance of the Teeth are emitted certain *Efluvia* through their pores, the transpiration of which being hindred, (by the obstruction of those invisible passages) the Teeth become liable to all those infirmities hereafter to be mentioned.

The substance of the Tooth being rigid and inflexible, it cannot be *Opilated* by contraction, or astringion: as the skin usually is but only by the intrusion of some extraneous matter into its pores, or the incrustation of some slimy stuff upon its superficies; which is done when we eat any thing of a glutinous nature, for then some of its most viscus parts do stick, and cleave about the *Teeth*; and by the mixture of some tartarious particles coming from the Lungs, the heat of the mouth, and a certain petrifick juice distilling into the mouth, out of the *Salival Ducts*, is turned into a stone-like substance, commonly called the scales or scurf of the *Teeth*: these scales grow thicker and thicker continually, and if let alone, will cover the *Teeth* all over, except just at the top were they grind one against another.

Having thus taken notice of the production of those scales, let us now consider of what ill consequences they may be to the *Teeth*. The first whereof is the *Opilation* of their pores, from whence proceed all the rest: for by that the exit of those *Excrementitious* particles before mentioned being hindred, it causes them to stagnate within the body of the *Tooth*, and there corrupting, do corrode it by degrees; beginning first by the alteration of its colour from white to yellow, and

and from yellow to black; and then follows the real decay of its substance, &c.

The said humor is not only destructive to the *Teeth*, but extends also its malignity to the Gums; some of its particles being subtil enough (after a due fermentation) to pass through the scales, and thence sliding between the Gums and the *Teeth*, they eat clear away the ligaments that tie them together, dividing them one from another to the very jaw-bone: which is sufficiently proved by the excoriation and rawness of the Gums, and their being so tender and loose from the *Teeth* where ever such scales are found; and especially if they be grown to a considerable thickness.

It happens sometimes that the usual passages of this corrupted humor being stopt by the scales, (when they are hard, and close enough) is thereby repercussed, and made to take its course towards the middle of the *Tooth*, discharging it self therein between the Concave superficies of the *Tooth*, and the *Tunicle* investing the same; where it occasions very great pains, and at last by its fretting, and corrosive quality, gnaws and consumes quite away the said membrane, as also the vessels of the *Tooth*; and then passing out of the said *Tooth*, it diffuses it self through the *Alveolus* or socket, where exerting its dangerous faculty, it destroys utterly whatever causes any connexion between the *Teeth*, the jaw-bone and the Gums, as the *Periosteum*, &c. After which the *Teeth* do consequently fall out for the most part sound, and unaltered, except only in their colour, (which becomes yellowish) by reason that the  
aforesaid



foreſaid *Excrementitious* Humour being at firſt diverted another way, did not ſtay long enough under the ſcales to occaſion in them a greater detriment; All which incommodities to obviate, keep only your Teeth clean from ſcurf, or any foulneſs; and if they be already clean, you need but to preſerve them as they are; but if not, get them to be made ſo by ſome Art in that Function; for otherwiſe if you employ any body that is unſkilful in it, you may chance to find the Remedy worſe than the Diſeaſe; by reaſon that not knowing the dangers attending ſuch an Operation, he may commit a great many and pernicious Errors, as the breaking of the *Film* that unites the Gums to the Teeth, the taking away of the gloſs of the Teeth, &c. Soon after which, the Tooth will loſe its natural luſtre, and become yellowiſh, ſubject to ake, and at laſt wholly periſh away, the Gums being looſe and broken, will likewiſe decay, and fall away from the Teeth; &c.

Your Teeth being once clean, you may preſerve them with this compoſition; Take *Magiſtery of Pearls*, *Powder of Coral*, and *Dragons-Blood*, of each equal quantity, and as much *Red-Roſe-water* as will incorporate them together; and make the Compound of a mean conſiſtence, between hard and ſoft. I have to that effect a very excellent *Dentifrice*, which being uſed only once a week will keep the Teeth clean and white; and by the conſtant uſing of it, fetch up their colour, if loſt; (tho in a conſiderable meaſure) this is the ſame that in my *Bills* (to keep my Maſters term, tho improper,



as he well knows himself,) I call an *Opiat*.

SECT. III.

*Of the Corruption of the Teeth, with their Remedies; Where-  
to is Annexed the Description and Use of the Polican.*

**H**AVING in the former Section considered the *Teeth*, as at the beginning of their decay, in such a condition as tho they suffer some light change in their accidents, yet their substance, form and proportion remaining still the same, is only called alteration; that is, in a state wherein indeed they are invited, and assaulted by their greatest enemies, but yet in a capacity of being rescued and preserved from their harms. But now we shall consider them as overcome by all those threatening evils, and really corrupted; in which case, all that can be done, is to prevent their total ruine.

And as there are some not so far gone, but that they may still do good service, if timely helped, we are to use our utmost indeavours to do it; which to effect, we shall in the first place clear their outside from all foulness, and then with a proper Instrument scrape off whatever is rotten within, washing them very well afterwards with some convenient liquid, to scour and smooth away what the Instrument may leave behind: and then if the Tooth be so hollow that it may be stoppt, it must be fill'd up with such ingredients as are neither corrosive, nor ill tasted, and of a consistence firm enough to be used in the same man-

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ner as the *Teeth* are, and to keep from wasting for a considerable time ; but if the *Tooth* rots every way equally, so that there is no cavity left, wherein any thing can keep fast, it must only be kept clean, taking care after every meal to pick out any meat that may get into it, and then wash it very well with fair water ; for if you neglect so to do, the corruption of the rotten *Tooth* will fall upon the others, and so infect all the rest.

With these precautions, I would advise every one to keep his *Teeth* as long as he can, although they were rotten to the very Gums, provided only they do not ake, by reason that their stumps filling up their sockets, serve (like so many wedges) to keep the others straight and firm in their places ; but if they are very bad, and withal subject to ake, it is better to have them out, lest they should occasion an ill habit in the Gums, that might be hurtful to the sound ones.

The Drawing out of *Teeth* is practised by a great many, but perhaps understood but of very few ; and I am sure that there is a great deal more danger in the Drawing of a *Tooth*, (especially out of the lower Jaw, than most people are commonly aware of. It is an Operation that requires to be performed with great care and circumspection, and not so rashly as it is commonly done.

But as the greatest difficulty of this Business lies in understanding the make, and application of the Instruments that are imploy'd about the Drawing of *Teeth* ; I shall (for the benefit of *Practitioners*, as well

*The Operator for the Teeth.*

as of those that will be their *Patients*) subjoyn here, the description and use of the *Polican*; which is one of the best of them.

*The Description and Use of the Polican.*

**T**HE Construction, and usual shape of the *Polican*, is a thing so well known by every body, that it would be needless to insist at all upon it. And therefore, without losing time in such superfluous Discourses, we shall here take notice of some other things appertaining to the said Instrument, more material and useful: as the due proportion that its parts ought to have, considered in themselves, and in respect of each other.

In the first place then, (supposing that you know the stuff wherewithal it must be made, which ought to be a tough steel, or steel and iron together) let the tree of the *Polican* be about four inches long, and so perforated, that the distance betwixt the centre of the hole (wherein goes the pin, upon which are fastened the two branches) and one of the extremities, be a line greater than the other. Let one of the two branches be two lines longer than the other; let also each claw be three lines long. And finally, let the distance between the bolster, or semicircle of the longest side of the tree, be two lines. And you will have four distances between the claws and the bolsters, which is sufficient to draw all sorts of *Teeth*. For with the first, which is of two lines, you may draw the *Incisores*.

With the second, of three lines, you may draw the *Canine*. With the third, of four lines, the *Double* and *Feeble Teeth*. And with the fourth, of five lines, the *Quadruple* ones.

Your *Polican* being thus made, if you have a mind to use it, you must so apply the Claw to the inside of the *Tooth* you intend to pull out, that its branch may stand exactly upon the middle of the said *Tooth*, gently leaning your Bolster upon the next to it, the better to take your measures; and then draw the *Tooth* out. But take heed you do not draw *obliquely*, but in a direct line from the *Tooth* outwardly; for in drawing laterally, you might chance so to force the *Tooth* to be drawn, upon the next to it, that you would draw them both together, or at least loosen very much the sound one, and put a far greater force upon the other in drawing it, than is necessary. Which would occasion an infinitely greater pain to the *Patient*, than if you had done it rightly.

Thus much have I thought fit to tell you concerning the nature and use of the *Polican*; which if you observe punctually, you need never fear the Drawing well of any *Tooth*. As for the rest of the Instruments now in use, with several others of my own Invention, I shall give you the particular Description, and use of every one of them in the next Impression of this Discourse; if you think this worthy of your acceptance.



SECT. IV.

Of the Restauration of the Teeth.

**W**Hen our decay'd Teeth are so far gone before we think of any Remedy for their preservation, that whatever we can do, proves but fruitless; And that notwithstanding all our best indeavours, they perish, and rot quite away; or that some intolerable pain has made us to draw them; we are not yet to despair, and esteem our selves toothless for all the rest of our life: the loss indeed is great, but not irreparable; there is still some help for it, the natural want may be supplied artificially, and herein Art imitates Nature so *nearly*, that when the *succedaneous* Teeth (if I may so speak) are well set in, they cannot be distinguished from the natural ones, (neither in colour, firmness, nor proportion) but by them that know of it. Being thus exactly fitted to their place, they will keep the next to them, and by consequence all the rest of that Jaw abundantly firmer and stronger than they would otherwise be.

The Advantages that may be attributed to the artificial Teeth, are many; as that they keep the others fast, as we said just now, that they are of a great ornament, and help pronounciation extremely, &c. But all that is with a *Proviso*, that they be well made, and according to the best Art; for otherwise they might prove quite contrary.

Besides this Artificial way of repairing the loss of



*Teeth*, there is another that may be called Natural; which is done by taking out the rotten *Teeth* or stumps, and putting in their places some sound ones, drawn immediately after out of some poor body's head: which thing (tho difficult) I know to be feasible enough, not only by my own reason that tells me so, but by experience it self, as (to say no more at present) may be instanced in the case of a certain Lady, who thinking to have *two Teeth* growing one on the top of another, came one day to my Master to have one of them Drawn: my Master told her that they were not two distinct *Teeth*, but only a double one; but the Lady being not satisfied with this, desired him to take out the *Tooth* she had told him of, let it be what it would. The *Tooth* being drawn out, and proving as my Master had said, it was quickly set again into the Jaw; and with the use of some convenient and proper Remedies, became in few weeks to be as firm again, as any of the rest.

And yet although the event of this particular had not proved so prosperous as it did; its ill success would not destroy in me the possibility of such a transplanting, or *Inoculation of Teeth*: (if I may be permitted to use such terms) that was not the only motive I had to believe it; and I have not inserted the Story of it here as an Argument to prove invincibly what I say, but only as a proper Example to render probable to others what I know to be true. However, I do not like that method of drawing *Teeth* out of some folks heads, to put them into others, both for its being too  
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inhumane, and attended with too many difficulties; and then neither could this be called the reſtauration of *Teeth*, ſince the reparation of one, is the ruine of another; it is only robbing of *Peter* to pay *Paul*. But if inſtead of humane *Teeth*, there is uſe made of thoſe of ſome *Brutes*, as *Dogs*, *Sheep*, &c. In ſuch caſe I do not only approve of it as lawful and facile, but do alſo eſteem it as very profitable and advantageous; only care is to be had, that the thing be undertaken, and carried on by one that at leaſt knows ſomething of *Anatomy*, and has a right ſenſe of the thing to be done, being furniſhed with whatever is neceſſary in an Operation of that nature.

And that (if my Opinion may be any wiſe ſerviceable in ſuch an Attempt) I may contribute ſomething towards the improvement of ſo uſeful an Invention; I think one is, to proceed in it ſomewhat after this manner. Firſt, I would chuſe an Animal whoſe *Teeth* ſhould come neareſt to thoſe of the *Patient*; as a *Dog*, a *Sheep*, a *Goat*, or a *Baboon*, &c. and having tied his legs together, I would faſten his head in ſome convenient place, ſo that he might not ſtir in the leaſt, and by ſome proper means keep his mouth open as long as I ſhould have occaſion: that done, I would open the Gums round about the *Tooth* to be taken out of his head, not only to the very Jaw-bone, but as far between the ſaid Bone and the *Tooth*, as the fineſt Inſtrument could go, leaving a very little portion of the Gums about it; and then having uſed the ſame circumſpection, in dividing the *Patient's* *Tooth* from the  
Gums,

Gums, and the Jaw-bone, I would draw it forth, and put immediately in its place that of the Brute; fastning it very well and freight between the other Teeth: and then with the use of suitable Remedies, I do not question in the least but that it would unite to the Gums and Jaw-bone, and in a little time become as fast as any of the others: which performance might properly be termed the natural Restauration, or *Renovation of Humane Teeth.*

### SECT. V.

*Of the Tooth-ake, Looseness of the Teeth, and decay of the Gums; with their Remedies.*

**T**HE *Tooth-Ake* is occasioned many and very different ways, but that I may render what I have to say upon it, as perspicuous and intelligible as I can; I think it very convenient we should take a special notice of the vessels that come into the Tooth, and of their respective Functions. The first and chiefest whereof is an Artery, whose Office is to bring directly from the heart that hot and spirituous blood, out of which (although it is not the general Opinion) the Tooth is at first made, (as well as the rest of the whole body) and ever after preserved and repaired by the supply of nourishment, and vital principles it affords continually: To this effect the whole Artery divides it self into an infinity of small branches, which being disseminated throughout the whole substance of the Tooth, distribute to each part as much of their blood

blood as is necessary to make up the incessant loss they are subject to; and the rest is returned through innumerable hair-like veins into the great ones, and thence to the heart again, but in two different manners: for the superfluous part of that portion of the blood, that is carried by the *Capillary Arteries* to that part of the Tooth standing above the Gums, is sent back again through some *Capillary* veins towards the middle of the Tooth; where uniting together, they make but a single channel; and this is it we commonly call the vein of the Tooth, which we shall here take for its second vessel. But the remainder of the blood, that goes to the relief of that part of the Tooth that is within the Gums, passing quite through the substance of the Tooth, is carried by the *Capillary* veins to the veins of the Gums, Cheeks, and Lips; and hence it is that whatever pain is at any time occasioned in any of those parts, (either by bruise, excessive heat, or cold, &c.) comes to be soon after communicated to the Teeth.

The Third and Last Vessel of the Teeth is a Nerve; one of the extremities whereof is expanded through the *Membrane* that invests the cavity of the Tooth, and that, that contains its Vessels; and the other is rooted in the Brain, from whence it takes its *Origine*, and where the Animal *Spirits* being elaborated, are thence sent by the Nerves to all the parts of the body, to administer sense, and the cause of motion to them, &c. although in some, (as the Teeth) the faculty of motion is not exercised.

From



From this consideration of the Vessels of the Tooth, we may gather the following reasons of its Dolour; As first, that if either through the too great quantity, or ebullition of the blood, the Artery is so dilated and swoln, that it fills up the hole at the end of the fumps where it enters the *Tooth*, and consequently so compresses the vein going out the same way, that the circulation of the *Blood* is thereby hindered; the continual flowing in of the *blood* will extremely puff up, and distend the *membrane* that contains the vessels, and consequently cause a great pain in the *Tooth*, which will last till either the *preternatural* state of the *Blood* be changed, or that the *Arteriols* which we have said to pass quite through the rooty part of the *Tooth* be so stretched and widened, that by them the *Blood* may be discharged into the Gums, Cheeks and Lips; where it will then cause a swelling, greater or lesser, according to the quantity of the superfluous *Blood*.

And if at the beginning of this disorder, when the Vein is first impeded in its *Function*, the motion of the *Blood* is so rapid, and its influx into the Tooth so impetuous, that before it can make its way through the small *Arterial* Twigs into the Gums, it does extremely extend the coats, of the *Artery*, the *Interstices* between their *Fibres* will thereby become wide enough to give passage to some of the thinnest parts of the *Blood*; which gathering at the end of the root, between the outside of the *Artery*, and the common Coat investing all the Vessels, will there putrefie, and cause a great and very lasting pain in the Tooth; during which,

if



if the Tooth be drawn, the said gathering will appear at the end of its stump like a little Bladder.

You shall know this sort of *Tooth-Ake* by the high beating of your Pulse, the fulness of the Veins, and an often beating in the affected Tooth; with a continual, tho not very extreme pain. And then for the Cure of it, you must first bleed the Gums, and sometimes open a Vein in the Arm also, and wash your mouth with *Rose-water* and *Vinegar*, of each equal quantities mixt together; putting a little Cotton dipt in Oyl of *Box* into the Tooth, if it be hollow.

Furthermore, if that portion of the *Blood*, which is diffused through the substance of the Brain for the production of the *Animal Spirits*, is so depraved, that all the sifting it receives, through the hidden *meanders*, and recesses of the Brain cannot clear it from its impurities; and that notwithstanding all the contrivances of Nature it is deposited into the *ventricles* of the Brain, (tho under another form yet) still impregnated with its ill qualities: such sort of *Animal Spirits* being compounded of *Heterogeneous* parts, if not timely discharged of their malignant and offensive *Corpuscles*, (through the usual *Emunctories*) will either by their fermentation in the *Ventricles* of the Brain, cause an *Head-ake*; or by the *oppilation* of its pores, cause a giddiness; or else passing out of the Brain into the Nerves, will by their irregular motion, and preternatural extention of the coats of the Nerves, and other *Tunics*, breed a disturbance in all the parts they go to; but more particularly in the Teeth, in which they

always excite very great pains. For discharging the peccant humour, between the *membrane* that invests the inside of the Tooth, and that that incloses its vessels, it occasions a perpetual torment in them, till it be expelled from thence by *transpiration*.

This second kind of Tooth-ake will be known by a disturbance in the head, which precedes it most commonly; a foreness in the joynts, and a certain drouiness, and lingring pain all over the body, as if one were inclined to an Ague, with a sharp and very excessive pain in the distempered Tooth, which comes by fits, soon ceasing, and often beginning a-new. As for its Cure, it may be effected by *Sternutation*, the *friction* of the *nape* of the Neck with warm clothes, and the application of *aperitive* Remedies, to open the *pores* of the Tooth: and if it be hollow, you shall put in't a drop of Oyl of *Camphire*, whereinto has been infused some *Henbane-root*. These are the two general causes of the Tooth-ake; all the rest proceeding from them, some few excepted.

There is what I had a mind to say at this present concerning the Tooth-ake. But you must note further, that as it is not enough for one that intends to travel a *Countrey* over, to understand the *Map* of that *Countrey*; but he must also inquire often of the people he meets with as he goes on his journey, for the way to such and such a place: so although I have given you a true account of the Tooth-ake, and have delivered here the right method for the curing of it, yet that Disease is for the most part accompanied with  
several

several circumstances, that can't be learnt but from experience it self. Thus sometimes the Gums will be *livid*, sometimes *pale*, and sometimes *red*, and inflamed. Sometimes the Tooth is loose, and risen above the others. And sometimes its root is discovered, and bare of flesh. Sometimes its rotten, and otherwhile *sound*, as to its *substance*. In fine, sometimes the pain is accompanied with a great *fluxion* of *Rhume*, and sometimes with a dryness of the *mouth*, &c. Each of which *concomitants* requires a particular consideration, and peculiar Remedies: considering always these things, with reference to the age, constitution and habit of the Patient.

Again, it is but rarely, that a *Tooth-ake* is found *simple*, or *uncompound*: (as we have supposed to be, those of which we have treated above) that is, occasioned by one cause only: but it proceeds most commonly from several; and especially if the pain be inveterate, or of a long standing. And then, the *symptoms* of this complicated Disease, are mixt in the same proportion as their *causes*; which renders the Cure much more difficult, and subject to more observations. And therefore, if any one has a mind to render himself perfect in these things, he must not only follow our method, that directs him to the true *knowledge* of them, but the *dictates* of his own senses also; by which he will avoid all the *obstacles* he may meet with by the way. Notwithstanding all which, people being commonly unwilling to undergo all the trouble attending a *methodical Cure*, and withal apt to think, that one does them

no good at all, unless he gives them ease presently; I have been forced to abandon the *Art* in my practice, and to invent certain general Remedies; which nevertheless applying with *circumspection*, and as I think occasion requires, hardly ever fail of producing the intended effect: sometimes in an instant, but most commonly within less than half an hour. True it is, that were it not for my former practice, and long habit in those things, I neither cou'd have, nor expect so good a success.

And yet I will not deny, but that the said remedies happen sometimes to *operate* a great deal slower than ordinary. But that comes to pass by reason of some unexpected, or unobserv'd *accidents*: and I think it ought to suffice, that the Cure be at last performed. Yet this does not satisfy every body. If the Remedy does not immediately Cure such as are *Impatient* or incapable of reasoning, they strait condemn it as a thing ineffectual, and altogether void of any *Virtue*. Upon which, believing the Stories of some impertinent (tho perhaps well affectioned) friend, they make use of such things, as commonly hinder the effect of the Remedy. And if it happens sometimes that notwithstanding those impediments, our remedy produces its effect; they never fail of attributing the Cure to their own indeavours.

However, I must ingenuously confess, that my Remedies do not take effect always. And that there are some sorts of *Tooth-ake* almost incurable, unless it be *palliatively*; and that it self, not without a great deal



deal of trouble, and a tedious while. The reasons of which, I shall take occasion to explain some other time.

The looseness of the Teeth, comes most commonly from the decay of the Gums, which are subject to many infirmities, proceeding for the most part from those things that occasion the *Tooth-ache*, and putrefaction of the Teeth; for sometimes there will be such an affluence of *blood* from the Teeth into the Gums, that their veins being not able to contain it, are thereupon broken; shedding the *blood* between the Gums and the Teeth: where gathering together, it corrupts, rotting away all the flesh from about the Teeth: otherwhiles the *excrementitious* humour, that *exsudates* out of the Teeth, falling upon the Gums, eats them away by degrees, &c. But above all other things, the scales, and foulness of the Teeth are very prejudicial to them. All which infirmities to avoid, you need but to keep your Teeth and Gums neat and clean from any foulness whatsoever; as has been already said in the foregoing Sections: preventing any preternatural collection of *Blood*, or any other humours within the Gums. But if the mischief is already done, that is, if your Teeth be really loose, and your Gums wasted, you must have recourse for their recovery to one well versed in those things. For to prescribe you here any form of Remedies, would be to no purpose, since the same thing cannot be equally good in all cases, and that without the perfect knowledge of the cause of the Disease, and a right method in applying suitable Medicaments, (which commonly is understood only by  
Practi-

Practitioners in those concerns) it is impossible ever to perform the Cure of any Distemper.

Yet, that you may not think me remiss in any thing belonging to my Profession, that may concern your welfare; and by reason that you may chance to find your selves in a place where there will be no *Artist* to help you; I will here communicate to you a general Remedy against the decay of the Gums, and looseness of the *Teeth*; which I am sure, if you use carefully, will often answer your expectations: At least it will be such, that it shall always do you some good, and never any harm. But I must tell you before-hand, that if your body be *Scorbutick*, and full of ill humours, you must first be *Blooded*, and *Purg'd*, according to the directions of a good *Physitian*: and then you may use the said Remedy as followeth.

Take of *Mastick*, *Myrrh*, *Pine-Apple*, *Dragons-blood*, in drops, all reduced into Powder, of each equal quantity, red *Coral* prepared, flowers of *Pomgranats*, of each double the quantity of the other *Ingredients*; and steep them all in a proportionable quantity of *Spring-water* upon warm *Embers*, for the space of a natural day; and then *filtrate* the *Infusion* through a woollen-cloth, and keep it close in some convenient vessel. And when you have a mind to use it, you shall take two or three spoonfuls on't a day, keeping it in your mouth a quarter of an hour every time: which you must continue to do while necessity shall require it.

I might have told you at the beginning of this Section, where I spoke of the vessels of the Teeth, that their

*The Operator for the Teeth.*

their Artery comes from the *Carotids*; the vein from the *Jugular*, and the sinew from the fifth pair of Nerves: but if you are skilled in *Anatomy*, you know it better than I, and if not, my telling of it to you would signify nothing at all, unless I should in the same time, give you an accurate description of all those vessels; tracing them from their *Origine*, even to the very last of their Divisions, and furthest extremities; which would be improper in this place.

SECT. VI.

*Of Childrens Teeth.*

HAVING hitherto spoken of the *Teeth* in reference to adult persons, and such as are past childhood: we shall explain in this Section, as succinctly, and withal as clearly as we can, what is necessary to be known touching their growth, and change in children; a thing of no small consequence, since the life of Infants is therein so often concern'd.

The Child being born, remains *Toothless*, till he is about five or six Months old: at which time his two foremost Teeth in each Jaw begin to appear, without keeping any constant order of Precedence: sometimes those above coming out first, and sometimes those below. After them follow all the rest successively in both *Mandibles*: so next to these come the four other *Incisores*, the four *Canin* or *Dog-Teeth*, and the first eight *Molares*, (which are properly the double *Teeth*) and then come the four biggest *Teeth* of all, which may be called

called *Quadruple Teeth*, as being about three times bigger than the small ones: and after that the eight last *Teeth* do follow; which in respect to the *Incisores* may be termed treble *Teeth*. But these treble ones usually vary very much in time of growth, for it is but rarely that they all come forth in the same year, the four last of them seldom coming out before the one or two and twentieth year of our age; for which reason such *Teeth* are called by some, *Teeth of Wisdom*; because that by that time, we should have a full use of our rational *Faculty*, though God knows how often it proves to be true.

The eight *Incisores*, and the four *Dog-Teeth* come the first year; the eight double *Teeth* the second year; and the four *Quadruples*, with the four first *Treble* ones, the third. During the time of their eruption, and especially when the four *Quadruple* ones break forth out of their *Sockets*, children are subject to Fevers, and great alterations, which weakens them extremely, and often puts an end to their days; which comes to pass most commonly, for want of help to facilitate their issue out of the *Gums*.

And as I look upon the knowledge of Childrens *Teeth*, as a subject properly belonging to my Profession; so I think my self oblig'd to amend, amplify, and render it as conducive to the preservation of the life, and health of Children, and to the preventing of all those Infirmities wherewith they are afflicted, (upon the account of the first coming, and shedding of their *Teeth*) as my weak indeavours can make it.

And



And therefore I will to that end deliver here in few words, what reason and experience have taught me concerning the same; Proceeding thus,

In the first place, I would advise such as may be concerned in this Affair, to take a special care in observing when the Child's *Teeth* begin to trouble him: which (besides his frowardness, and excessive crying) may be known by his *salivation* or drivelling (as Nurses are wont to stile it,) and the inflammation and swelling of his Gums; and as soon as you perceive it to be so, you are to wash his mouth now and then with the following mixture: Take seven or eight as new *Figs* as you can get, and boyl them in a pint or more of *Whey*, till they grow very soft, and then squeeze the *Whey*, and as much of the substance of the *Figs* as you can through a cloth; of which liquor take half a pint; of Honey of Roses, and Syrup of Violets, of each half an ounce; and three or four spoonfuls of *Plantain-water*: mix all together, and keep it close in a Bottel. The best way to use it, is with a stick of Liquorish beaten at one end into small threads like a Comb-brush, or little Broom, with which, being dipt in some of the said Liquor, you shall wash and rub the Childs Gums, (especially where they are tumified) at least five or six times a day, continuing so to do, till you perceive the Gums to grow white above the *Tooth*: (which is a sign of great pain in that part, and that the young *Tooth* will in a little time break through the Gums) and then take a *Lancet*, or a very sharp *Pen-knife*, and divide the white place, cutting it

down to the head of the subjacent *Tooth*, with two *Incisions* crossing one another at the centre of the white spot, continuing to use the mixture as is aforesaid, till the *Tooth* appears above the Gums; observing to use the same method at the coming out of every *Tooth*, which you may know by the foregoing tokens.

Now the *Teeth* being all come out (except only such as remain latent within the Jaw, till about the two and twentieth year of ones age) they keep firm and strong till the child is a matter of six or seven years old, and then most of them grow loose, and a while after are cast clear out. The *treble Teeth* never change, the *Quadruples* very rarely, but the *Incisores*, the *Dag-Teeth*, and the double ones always do; sometimes whole, (and then the *second Teeth*, or those that are to succeed them, are a long time before they grow up again;) but most commonly their head only comes off, the other part remaining still for the making up of the next *Tooth*; like unto the first production of a Vegetable Seed, or tender Sprig of a young Plant; for as the upper part of this being withered in the *Winter* following, by the rigorous cold of that Season, drops off in the next Spring: (by reason that its texture being yet loose, and less firm, the pores or sap carrying vessels, are over much dilated by the great affluence of the *nutritive* juice, and so give admittance to some indigested and grosser *particles* than is convenient for the nourishment of the Vegetable; which *particles* being irregular, and unactive, their motion is soon stopt; when-as a great cold intervening, compresses a little  
the

*The Operator for the Teeth.*

the young Plant round about, so that they are congeal'd, and become fixt in their *Ducts*, or leading pipes, whereby that part being deprived of its due nourishment, fades away, and dries up,) and is succeeded by a new Sprout shooting out of the stump, or remaining part. So likewise the young *Teeth* coming into the cold air, when they are yet tender, and less solid: those of them that are more susceptible of alteration, and more exposed to the inclemency of the weather; (as must be those before, which by reason of their smallness and situation, cannot but be more subject to *adventitious* accidents,) are thereby chill'd and repressed, and their parts thrust near one another, and driven back towards their centre, from whence the substance of the *Tooth* becoming closer, and the intervals between its parts narrower, and interrupted in several places, by the irregular motion of some of the minutest of those parts, (which by reason of their unstableness, and fluxibility, being disposed to advance and obey the action of external Agents more than the others, do move disorderly, and spoil the structure of the rest,) the small Veins and Arteries therein dispersed, will become so extremely compressed, that the blood they contain (which in Children is most commonly gross and impure, as is apparent by their stupidity, and filthy scabs; as well as by that Feverish disposition they are always inclined to; which argues a great disparity between the parts of their blood,) is thereby stop't in its course, and detained in them; where the grossness of its parts, and their incumbring figures will

soon dispose them to rest, and remain intangled and coagulated together.

If you chance to reflect upon what I say, when I ascribe the great agitation of Childrens Blood, and its being quiet and fixt in their Teeth, to the same cause, viz. its foulness, and the incongruity of its parts; you will perhaps be as angry with me, as the *Satyr* was against the Traveller of the *Fables*, for his blowing hot and cold with the same breath. But if you consider it a little more attentively, you shall find that this, as well as the said *Apologue*, may easily be reconciled with Reason.

Furthermore, the Blood coming from the live part of the Tooth, to enter the other; and being hindred thereof by the narrowness of the passages, and the resistance of the condensed blood, is upon that necessarily determined to imploy the force of its motion round about, against the parts lying immediately between the dead portion of the Tooth, and that which is alive; the which it consequently loosens by degrees, and at last breaks them all asunder; separating thus the live body of the Tooth quite from its dead head; and the space left between them permitting the *trunk* to grow, it shoots a new head; which rising above the Gums, thrusts out the old one, becoming a perfect Tooth in its room.

But if in the mean while, through the too great adherence of the dead part to the Gums, the other is depressed, or retarded from growing, and by consequence is detained under the former too long; some

of



of the broken particles remaining between them, will corrode, and eat holes in the new head of the Tooth, and so it comes out already perished: which to prevent, the first Teeth must be drawn out as soon as they appear any thing loose.

Moreover, it happens, sometimes, that the new head of the Tooth is nourished, and increases so fast, that being obstructed by the too great connexion of the old one, to the adjacent parts, from advancing in its right course; it turns aside, and makes its way through either the inside, or outside of the Gums; and so it grows biasing, and out of rank. This defect is remedied by drawing out the superfluous Tooth, and the use of some convenient means to bring the new Tooth into its place; which is very easy to do, if undertaken at first, but otherwise a great deal more difficult; and especially if the two next Teeth are approached so near one another, that it cannot be contained between them, without being lessened, or the others put further off from each other.

*Note,* That in drawing out the old, or sucking Tooth, a great care is to be taken not to hurt the new one, lying under it.

## SECT. VII.

### *Of the Acceleration of the Teeth.*

THE five first of the foregoing *Sections* have been imploy'd about mens Teeth, and the sixth about those of Children: but this seventh and last Section  
of.

of our Discourse shall respect both men and children; for it will not only teach how to hasten the growth of Childrens second Teeth, when it happens to be delay'd, or retarded too long; but also how to *Accelerate* the coming out of those in Men, that are called Teeth of Wisdom. Which last, without the help of Art, hardly ever appear before almost half of our life is already past away; And when the time of our growth is over: during which, we have the greatest occasion for them. But because the bare saying or asserting of any thing without proofs, or some reasons to render it probable, has no force to perswade any man of its truth, nor to make him sensible of what utility it is of; We will *elucidate* the matter in hand, by an example drawn from the motion of Seeds sown in the Earth. Now the quick or slow *germinating* of Seeds after they have been sown, depends upon their being buried shallow, or deep in the ground; the lightness or heaviness of the Earth, and its good or ill manuring, and the proportion of *humidity* that *dilutes* it, as well as the heat or coldness of the season: the several proportions of either of which accidents, alter and vary the progress of the Seed, according to their prevalency in respect of each other.

For in a well prepar'd Soil, being cherished by the warmth of the Sun, and duly *diluted* with water, the Seed will budd a great deal sooner; the lightsome Earth easily yielding to the *expansion* of the *Semen*, when it *imbibes* that *Succus Nutritious*, which *Transcolating* through the coats of the Seed, and impregnating its

*Paren-*

*Parenchyma*, causes by its fermentation therein, a gentle shake, and a vital motion in the *Radicle*, and *Plumes*, (as the Learned Doctor *Grew* calls the *Seminal Root*, and *Trunk* of a Plant in *Embryo*) whereby they are impowered to *Extricate* themselves out of their *Integuments*, and *Parenchyma*; and begin to *vegetate*; and grow like a Plant.

But the Seed being buried deep in a cold, cloggy earth; will, by the stubborn *Cohesion*, and lumpishness of the said earth, be kept from dilating it self, and consequently from receiving those particles that are altogether necessary for its *vivifying*, and *augmentation*. From whence it follows, that its growth (if not helped by Art) will be check'd, and obstructed till the heat of the Sun has opened the ground, and set its particles in such motion as they ought to be, to enter the Seed, and protrude the earth upwards.

So likewise Childrens Gums, being yet tender, shallow, and loose, and withal prepar'd, as we have taught heretofore in its place, their first Teeth come out, and grow very easily; as also do their second, if in shedding of the first, their heads only come off; for the others do grow up so soon, that the Gums have hardly any time to close up again. But if the sucking-Teeth do shed root and all, the matter out of which the next (which I call *Novel-Teeth*) are to be made, will not only be a considerable time in disposing it self into the requisite form, but when the first lineaments are drawn, and Nature has accomplished her first work, the Gums will be re-united together, and  
grown

grown so hard by that time, that their resistance will oppose it self to the growth of these Teeth, till a stronger nourishment produces more and hotter Blood, and a greater quantity of *Animal Spirits*; by which the Gums being made hotter, and more spongy, and the nutritive juice increased, the issue of the said Teeth will then be facilitated, and their growth perfected.

To the consideration of these *Novel-Teeth*, may partly be referred that of the last treble ones, or *dentes sapientia*. It's true, these are stay'd a great deal longer under the Gums than the others; but also they have more causes that impede their growth. For, besides that, the Gums are more sinewy, and membranous about them than any where else, and therefore much more difficult to penetrate: That part of the Jaw-bone that contains them, is likewise much thicker, and stronger than any other; and consequently, harder to be divided by the included Teeth; which being incapable of making their way through it, are forced to stay therein till such time that Nature having perfected our growth, the blood becomes hotter, stronger, and its energy more powerful by the firmness of the Heart, (which is the Sun of our *Microcosm*, or little-world) and other principal parts, and increase of those particles that were wont to be employed in making up, and augmenting the body; most of which remain then in the mass of the Blood: whereby the said blood, being able to surmount the resistance of the Jaw and Gums, forces the said Teeth to come out of their cells, and grow up.



To the efficacy of this new strength of the *Bloud* upon the arrival of Nature to its highest *Period*, may be attributed the causes of those alterations that usually happen in mens bodies about that time: many looking pale, and being troubled with divers infirmities till then, of which they are afterwards delivered. But leaving off Digressions, let us return to our Subject.

We have already observed, that the *Novel-Teeth* in Children, and *Dentes Sapientie* in Men, cou'd not arrive to their perfection, nor therefore become serviceable to us without a long time, and a great *Effort* of Nature. It remains now, that (pursuant to our design, as we have declar'd it at the beginning of this Section) we endeavor to find out some means, whereby we may remedy those defects; in *facilitating* Nature's work, and rendring those *tardy Teeth* above-mentioned, serviceable to us as soon as we can. And as I find none more proper and expeditious, than the *Rarification*, and *Dilatation* of the Gums, so that they may lose their greatest stubbornness, and become more yielding to the *Teeth*: I conclude that all the difficulty lies in knowing how such an effect can be produced: which (after a due consideration) I think may be performed after this manner.

In the first place, there is need of an Instrument made of Gold, or Silver, about a foot long, as big as a Tobacco-pipe, and like a *Syringe*; being so bored, that a perfectly *Cilindrical embolus*, or sucker, may fill exactly nine inches of its *Cavity*; the rest being made a good

deal smaller, and bow'd like the Blowing-pipe of Watch-makers; which ought to end into an head resembling the cup of an Acorn; and so contriv'd, that it may imbrace the Gums exactly. Your Instrument being ready, if you have a mind to perform the Operation, you must in the next place (concerning the *Dentes Sapientie*) tie all the Teeth together, (which may be done without any trouble) so that the two foremost of them may draw the last of all towards the fore-part of the mouth. By this the included Teeth will be freed from being compressed between the others, and the extremity of the Jaw-bone. And then the Gums being prepar'd by *Emollients*, and relaxing things, apply the end of your Syringe close upon the Gums, under which the imperfect Tooth lies; and then draw the *Embolus*, and the top of the Gums will follow, and rise within the little Acorn-cup-like end of the Pipe, as the flesh usually doth under Cupping-Glasses. Keep it a while so, and then take away the Syringe, and scarifie that part of the Gums that was drawn within the Pipe, in several places; reiterating the same Operation twice a day, for about a fortnight, omitting only the Scarification, which is to be used the first time only. By this means it appears probable to me, that the Gums yielding, the force of the Blood will compel the fibres or minute parts of the imperfect Tooth, to advance according to their natural order, and situation; and so cause the said Tooth to grow.

As to the *Novel-Teeth*, you shall follow the same method, and use the same means in facilitating their coming

coming out, that you have done to the others ; omitting only the tying of the Teeth, which would be *superfluous* here.

Note, that every thing is not capable of the same perfection, and that as there is no rule without some exception ; so when I have asserted such and such things to be improvable to such a degree, it is to be understood for the most part, and in general ; not denying but that it may happen otherwise in some particular cases : but I shall always deal candidly with every body, never undertaking any thing but what I shall be able to do according to agreement. And if any one will be pleased to come to my Chamber, he may have my Advice (concerning any thing that belongs to my Profession) *gratis* at any time.

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# ADVERTISEMENT TO THE READERS.

GENTLEMEN,

**A**lthough I have offered nothing in this Paper, but what is according to my own Experience, and the best of my knowledge; yet I will not say but that I have been deficient in many things, and have committed a great many Errors in the management of my Subject; but if you consider that I am the first (as far as I know) that ever wrote any thing of this nature; and withal, what is to be expected from one in my Circumstances, I hope you will be the more ready to excuse my faults. However, if what I have done be acceptable to you, I intend in a second Impression of this small Treatise, to Correct, Illustrate, and augment it, to its full proportion. In the mean while I would advise you, to make use of what is here presented you, by

Your very Humble Servant,  
CHARLES ALLEN.

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Printed in the Year 1686.



# Physical Discourse

WHEREIN

The Reasons of the Beating of the PULSE,  
or Pulsation of the Arteries; Together with those of  
the Circulation of the Blood, are Mechanically Ex-  
plain'd: Which was never done before.

**T**He Beating of the Pulse being one of those *Phe-  
nomena*, that deserve mans consideration the  
best, it has excited the most Learned in all Ages to  
search out what might be the cause of it.

The best *Physitians* and greatest *Philosophers* of former  
times, being ignorant of the *Circulation* of the *Blood*,  
did ascribe it to their occult qualities, and unknown  
powers.

*Galen*, an Eminent *Physitian*, searching the natural  
cause of the *Beating of the Pulse*, thought upon the  
making of that famous Experiment of his; by which,  
having put a Quill into an *Artery*, and tied the *Artery*  
upon it, he found that the said *Artery* ceased from  
beating betwixt the ligature and the extremity, tho  
it continued still beating betwixt the same ligature  
and the heart: And then seeing also, that the *Artery*  
being

being untied from about the Quill, the Pulse would immediately pass beyond the place where the ligature had been made, and beat all along the Artery; altho the capacity of the Quill remained still the same, he concluded, that the Pulse was caused by a *Pulsifick* faculty residing in the coats of the Artery.

*Gassendus*, a Modern and most Learned Philosopher, attributed the said effect, to the *Pulsifick* Faculty of the heart; which, in his opinion, communicates it self to the Arteries. Both which opinions (altho propos'd by extraordinary men, yet) are so inconsiderable, that they need no refutation.

The most Learned and most Profound *Cartesius* was of opinion, that the *Beating of the Pulse* proceeded from the motion of the Blood, which coming out of the left Ventricle of the Heart into the Aorta, in a tumultuous manner, extends it self forcibly, and thereby drives all the mass of the Blood, from the heart to the heart again, according to the Circulation of the Blood. After which this great Man (who would always give natural and intelligible reasons for every thing, as he has done for most;) coming (at the instigation of a Physician of Louvaine) to examine *Galen's* Experiment, he attributed the cessation of the Pulse, that happens below the ligature, to the narrowness of the passage of the Blood through the Quill; which Blood, according to the principles of the Philosopher, coming out of the said Quill into a wider space, cannot communicate its action to the sides of the Artery, but is disposed to imploy the force of its motion forwards, according to the length of the Artery.

But

But the said *Physitian* alledging against this, that if one takes an *Artery* without *Quill*, or any *Incision*, and ties its sides so close together, that there be left a far smaller passage for the *Bloud* in that place, than in the *Quill*; the *Artery* will nevertheless continue still to *Beat* on both sides of the ligature, as it did before: (the contrary of which wou'd necessarily follow, if it were so, that the straitness of the passage of the *Bloud* did occasion the loss of the *Pulse*) *Cartesius* was here forced to recede somewhat from his former *Sentiment*, and to confess, that the motion of the *Arteries* depends partly upon the free continuation of their coats, which totally overthrows his opinion. For, let the power of the said continuation be what it will; supposing, as the *Philosopher* did, that its action may be stop'd by the compression of the sides of the *Artery*: It is certain, that altho the *Quill* in the *Artery* were of equal, or, if you will, greater capacity than the *Artery*; yet if the said *Artery* were tied upon it, the *Pulse* would, notwithstanding all that, cease below the ligature. But *Cartesius* said, that such a *Quill* as that we were speaking of just now, being in an *Artery* either tied, or untied; wou'd never hinder any part of the *Artery* from *Beating*: And therefore, &c.

Doctor *Lomer* says, after many *Disquisitions* on this Subject, that the knowledge of those things was left to God alone.

Doctor *Willis* ascribes the *Beating of the Pulse* to the contraction of the circular *Fibres* of the muscular coat of the *Artery*: But it is absurd to think so; for its impossible

impossible to imagine that those *Fibres* cou'd contract themselves of their own accord; neither does the Doctor give any reason for what he says. Besides, he's inconsistent with himself, when he ascribes the same motions to the circular *Fibres* of the *muscular* coat of the veins; which are notwithstanding wholly destitute of any *Pulsation*, &c.

All which considering, and how these and other great men had (through the difficulty of the thing, and not out of any insufficiency in them) fallen into so gross and so erroneous opinions concerning the Point in Question; I concluded, that it was as good as impossible ever to solve the difficulty. Yet, recollecting my self, and seeing that the said Effect must have a cause, whatever it be, which probably cannot reside any where else, but either in the Heart, Blood, or coats of the *Artery*; or finally, in them all together; I made a resolution to examine carefully each one of these things separately, as possibly containing alone the cause sought after; and then all together, as being possibly Coadjutors in the *production* of the known Effect. And after as exact an Inquiry into the matter as I am capable of, my Reasons (which wou'd be too tedious to tell you now) perswade me, that all the Mystery consists in the three following things.

The First is, the Structure of the *Artery*; which is made up of four *Coats*. (We shall examine in another place how they are generated at first) The first of them, which contains the *Blood* immediately, seems to be *nervous*, and made of strait *Fibres*; which take their



their *Origine* from the heart; or rather are a continu-  
ation of those that immediately invest the *cavity* of  
the heart. As soon as they are arriv'd at the *orifice* of  
the heart, they rank themselves by one another; form-  
ing a certain *Cartilagineous Ring*; from the circum-  
ference of which, they run almost parallel along the  
*Artery*; but yet with such an inclination towards one  
another, that going from the heart to the extreme  
parts, they form a kind of *Cone*; (for that we may  
render our Discourse more intelligible; we shall con-  
sider here one of the trunks of the great *Artery*, (sup-  
pose the ascending one,) as a continued right *Conical*  
*Pipe*, abstracting from all its divisions and branches;  
to every one of which may easily be apply'd, what we  
are going to say of one of them,) a little below the  
*Apex* of which, those *Fibres* unite themselves together;  
and do compose a little *tendinous* ring, called *Anastomo-  
sis*: to which is affix'd the extremity of the *vena cava*:  
which vein we shall suppose here to be a single *con-  
ical* channel, or pipe, disposed, as we have taken the  
*Artery* to be. Within this *Anastomosis* there is a little  
*Valve* so dispos'd, that it permits the blood to pass from  
the *Artery* into the vein, but hinders it from returning  
back again from the vein into the *Artery*. Between  
every one of those *nervous Fibres*, there is a thin *mem-  
brane* that joyns them together; (as the skin in a Goose's-  
foot ties its toes to one another,) which permits the  
said *Fibres* to open, and go further from one another,  
when the *Artery* is dilated: And which do continually  
increase in breadth, as they go from the *Anastomosis* to  
G the

the *basis* of the *Artery*: so that they become so conspicuous near the heart, that Doctor *Willis* took them for some large fleshy *Fibres*; to which he assign'd the faculty of shortning the *Artery*, in order to promote the circulation of the *Bloud*. The second coat is the *Muscular*, and the third the *Glandulous*: but the consideration of these middle coats, being not necessary to our present purpose, we shall speak of them another time. As to the fourth, or outmost Coat, it is that which we have most need to take notice of here; as being the principal Instrument of the *Systole* and *Diastole* of the *Artery*. This Coat is made up of two orders, or ranks of *spiral Fibres*; which proceed from the *oblique Fibres* of the heart; from whence they go twisting and winding themselves about the body of the *Artery*, as *Ivy* does about *Trees*; some running upon it from the left to the right, and the others from the right to the left; intersecting thus one another *obliquely*, as they go from the heart to the *anastomosis*; whereby they form a sort of Net, or Sieve-like-woof upon the outside of the *Artery*. At their coming out of the heart, they are knitted together by a *cartilagineous* substance, that incompasses the root of the *Artery* round about, as an iron-ring does the end of a handle: from the circumference of which *cartilagineous* Ring, they run *Helix-wise* upon the superficies of the *artery*: at the extremity of which, being arriv'd, they insert themselves into the *tendinous* small ring, or *anastomosis*. These *spiral Fibres* are tied so loosely on the body of the *artery*, and so slightly between themselves, at the places where

where they intersect one another, that they may run very easily to and fro upon the artery.

The second thing conducive to the production of those stated turns of *Systole's* and *Diastole's* of the artery is, that the blood contains a certain subtil matter, of vital spirit, which can move it self, and pass between its parts very easily. And in fine, that the blood coming out of the heart (where it acquires an extreme agitation) into the *arteria magna*, expands it self with great violence, and strongly dilates that part of the said artery that lies contiguous to the heart, (forcing in the same time the blood to advance from the heart towards the extremity,) whereby the *spiral Fibres* being necessarily drawn towards the dilating place, do compress the artery round about all along, & so squeeze the subtil matter, from between the parts of the compressed blood, into that which is not; forcing it thus to pass from the extremity towards the heart, which makes the ebbing or *systole* of the artery. And then the *spiral Fibres* having been extended violently, and on a sudden, upon the dilatation of the artery, do (by the *Elastick* faculty of some of their parts) come back again, and restitute themselves into their former situation, and state; forcing thereby the subtil matter to fly through the blood, from the dilated place of the great artery, towards the extremity of the *capillary* ones, &c. which makes the flowing or *Diastole* of the Artery.

## THE EXPLICATION.

WE have already supposed the *Artery* to be of a right *Conical* figure; let us further, for greater evidence, imagine it to be mentally divided into four parts of equal capacity: so that as much as the first shall exceed the second in breadth, the second will exceed the first in length, &c. Let besides, the places of the suppos'd divisions be marked with several letters, as A, B, C, and let A, denote the first division; (proceeding from the heart to the extremity;) B, the second; and C, the third: let us also mark the *Basis* of the *Cylindrical artery*, which is inserted into the *basis* of the heart, by X; and its *capillary end* inserted into the circumference of the *annular anastomosis*, by Y.

And now, suppose that a certain portion of blood, as a dram for example, passes out of the heart into the *aorta*, where it swells, and dilates it self very considerably, (by reason of a very intense degree of heat, it acquires in the *ventricles* of the heart; and of its being mixed therein with a certain leaven, or fermentative juice, (it being the residue of that portion of blood, that had pass'd immediately before through the heart,) which necessarily causes a great commotion and strife amongst its parts;) it must follow according to true Philosophy, that the said portion of blood coming out of the heart, does in the same time thrust the blood already in the *artery*, forwards, and dilates that part of the *artery* that lies contiguous to the heart.

It



It thrusts the blood, I say, towards the extremity; because that it must occupy a space in the *artery* equal to its natural bulk, neither greater nor smaller; by reason that a like quantity of the blood to that, that comes out of the heart into the *artery*, is poured out of the vein into the heart; so that there is only room left in the vein to admit just as much blood, as comes out of the heart at each *Diaſtole*. And if we suppose the space X A, to contain a dram of blood, (whether more, or less, makes no matter here) as we have also supposed, that the same quantity comes out of the heart at every *Diaſtole*, (or *Systole*, as some would have it) it is an invincible truth, that this blood coming out of the heart, must exactly occupy the space X A; and that therefore, it thrusts in the same time, the blood that occupied it before, into the space A B; that in A B, into the space B C; that in the space B C, into the space C Y; and that in C Y, into the *capillary* end of the vein, &c. And altho (according to our *Hypothesis*) the passage from the *artery* into the vein be much smaller, than that of the heart into the *artery*; yet if the motion of the blood through the *anastomosis*, is to the motion of the blood at the *orifice* of the heart, as the *orifice* of the heart is to the *anastomosis*; that is, as X is to Y, (as it may easily be so, altho it is naturally otherwise: the rest of the *anastomoses*, from which we have abstracted here, being together at least as capacious, as the *orifice* of the heart,) it is plain, that a dram of blood will as soon pass from the *artery* into the vein, as another shall from the heart into the *artery*.

And

And as the blood coming out of the heart into the great artery, cannot possibly occupy a greater space, than such as is adequate to its volume in a condensed state; and that nevertheless it dilates it self, it must necessarily extend and dilate X A, the part of the artery that contains it, as much beyond its natural tone, or reach, as the rarefaction of the blood increases its volume; which cannot come to pass, but these two things must necessarily follow. First, that when the blood dilates it self, it leaves some intervals between its parts; which intervals (because there is no *vacuum* in nature) must in the same time be filled up with some other fluid matter: (which ought to be thinner than the blood; for otherwise it could not pass between its parts.) And as this subtil matter can't come from the heart, because that then it's empty; and that besides its orifice is shut close by its three valves; it can neither come through the coats of the artery, by reason of their thickness, and close texture; neither is there any such matter about them. It remains then only, that it must come from the blood contained in the artery.

Secondly, that the *spiral Fibres* must be drawn towards the dilated place, and the rest of the artery made as much narrower than ordinary, as X A, becomes wider than it uses to be. Whereby the artery being compressed round about, the vital spirit is squeezed from between the compressed parts of the blood, and forced to advance towards the dilated place; in such manner, that as much of the spirit, as is necessary to fill  
up

up the spaces left between the parts of the dilated bloud, is sent thither from between the parts of that, which is compressed; the remnant of the *spirit* being equally distributed through the rest of the *artery*; so that if every one of the four parts, or divisions of the *artery*, contains a certain quantity of vital *spirit*, distinguished into three parts, and that three of those parts, do pass from A B, into X A, two of them will in the same instant pass from B C, into A B; and one from C Y, into B C; in which action consists the ebbing, or *systole* of the *artery*. And as a rope, (or more sensibly, a gut-string) which is fixed to any place, being pulled with a jerk, will draw back again him that drew it at first; so likewise the *spiral Fibres* being extended violently, and on a sudden, upon the dilatation of the *artery*, do come back again *instantaneously*, (by reason that some of the parts of each *Fibre*, being strongly thrust towards its middle, and somewhat bent from its circumference towards its centre, do presently spring back again, extending themselves according to the breadth of the *Fibre*; whereby the said *Fibre* is necessarily as much shortned, as it had been stretch'd before) and restitute themselves into their former situation & tone; (which they are facilitated to do by the extenuation of that extraordinary agitation of the bloud; which it communicates in an instant to the yielding sides of the *artery*) forcing thereby three parts of the vital *spirit*, or subtil matter, to repass from X A, to A B; and the two parts, that were already in A B, to pass into B C; from whence another will pass into C Y, &c. which

which makes the flowing, or *Diaſtole* of the *artery*.

I foreſee an Objection, that ſome may make againſt what we have ſaid, that that portion of the blood, that comes out of the heart in its *Diaſtole*, is dilated, and yet occupies no more of the *artery*, than if it were condensed; only that part of the *artery* which contains it, is a little more extended than the reſt: for, they will ſay, this ſuppoſes, that both the *artery* and the vein are always full of blood; being certain, that if the blood, in coming out of the heart into the great *artery*, did find there any empty ſpace, where it might expand it ſelf freely, it would ſtart forwards into it, and then it wou'd not dilate the *artery*, nor by conſequence draw the *ſpiral Fibres*; and therefore there wou'd neither be *Syſtole* nor *Diaſtole* in the *artery*: But it is moſt certain, they will continue, that men have ſometimes more, and ſometimes leſs blood in their bodies: and that if a man has, for example, fifteen ounces of blood drawn, it will follow; that there being a vacuity in the *Sanguinoducts*, till the ſame quantity of blood be regenerated a-new, the *Beating of the Pulse* muſt alſo ceaſe till then; which being contradicted by daily experience, they will conclude, that the motion of the *ſpiral Fibres*, with whatever elſe we have taught concerning the *Beating of the Pulse*, is altogether *chimerical*. To which I anſwer in few words, that for the *Beating of the Pulse*, and Circulation of the Blood, it matters not at all, whether or no, the *artery* and vein be quite full of blood; ſince that as the blood decreaſes in them, the muſcles of the limbs, and other adjacent



adjacent parts, do proportionably compress them round about; so that their internal superficies touches the blood continually every way; which has the same effect, as if the artery and vein were exactly full of blood: for the blood coming out of the heart, and finding as much difficulty in lifting up the adjacent parts, as to drive on the blood of the artery and vein, when they are full on't; it's forced to keep the same order and method in that case, as it does in this, concerning its dilatation and place in the artery.

Now, these being the true and genuine reasons of the *Diastole*, and *Systole* of the arteries, it's very easy thereby to explain all the *Phenomena* relating to Galen's experiment. For the Quill being put into the artery, and left there without being tied, the artery will nevertheless beat still above and below the Quill, as it did before; because that the *spiral Fibres* can still play to and fro from one end of the artery to the other, without impediment. But if you bind the sides of the artery upon the Quill, the motion of the same *spiral Fibres* will be intercepted by the *ligature*; so that it must necessarily follow, (by the foregoing reasons,) that the artery being not alternatively compressed, and dilated betwixt the said *ligature* and the extremity, the *Pulse* must also cease in that part of the said artery, &c.

Many things may easily be explained by this Doctrine, tho impossible to be interpreted any otherwise; which therefore become as many proofs of its verity: as namely, the difference which is between the *arte-*

rial and venal blood. For (having demonstrated above, that when the blood advances in the great artery from the heart towards the *anastomosis*, and from thence into the vein, the vital spirit goes in the very same time from the *anastomosis* towards the heart; whereby the said spirit is necessarily kept within the artery;) it is certain, that this disparity proceeds from the want of spirit in the venal to keep its parts in agitation; which abounding in the arterial, keeps it in a continual effervency, &c. I could add many other things to authorize what we have said concerning the *Beating of the Pulse*, and *Circulation of the Blood*: but I hope this will suffice to rational men, and such as are of a *Mechanical Genius*. As for those that attribute all things to final causes, and have recourse upon every occasion, to the designs and intentions of Nature: (as when they say, that the Eye-brows are made to hinder the Sweat from falling into the eyes, &c.) if, notwithstanding all that we can do, they remain still insensible to our reasons, it matters not much; and, in my opinion, such persons had a great deal better study *Astrology*; or, if they are big with devotion, go and comment upon *Job*, or Paraphrase some *Psalms*; than meddle with *Physical* matters.

F I N I S.



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